REMARKS

Claims 1-30 and 54 are pending in the application. Independent claims 1, 20, and 54 have been revised to recite a solid oxide fuel cell that is prepared by a process whereby at least the solid electrolyte and anode are prepared by co-firing or sintering at least two layers to form a porous anode layer and a dense solid electrolyte layer, and impregnating the porous anode layer to form a porous anode with ceria, copper, or both deposited in the pores. The amendments are fully supported by the original disclosure and claims including, *inter alia*, Figure 2 and original claim 34.

New claims 55-61 also are added and recite similar subject matter to that recited in the original claims. The new dependent claims 56 and 57 recite the addition of copper to the ceria-containing anodes of independent claims 1 and 20, and are fully supported by the original disclosure. New independent claims 58, 60, and 61 are similar to pending independent claims 1, 20, and 54, but instead of reciting the method by which the anode is prepared, which the Examiner has agreed distinguishes the claims from the cited art (but it appears the Examiner has not given weight to the method recited in the product claims), these claims recite a porous anode comprising a porous material with at least ceria, copper, or both impregnated in the pores of the porous material. Support for the new independent claims can be found throughout the original disclosure and provisional applications that are incorporated by reference. Support can be found, for example, in Figure 2, and the accompanying description on pages 12 and 13 of the original specification. No new matter is presented by the amendments. Accordingly, applicants respectfully request entry thereof and reconsideration of claims 1-30 and 54-61 in light of the following remarks.

Pages 1 and 2 of the final Office Action dated December 19, 2005 ("the Action") reject claims 1, 15, 18, 20, 30, and 54 under 35 U.S.C. § 102(b) as allegedly anticipated by Mogensen, *et al.*, U.S. Patent No. 5,350,641 ("Mogensen). Applicants respectfully traverse this rejection.

Mogensen discloses a fuel cell comprising a thin layer of CeO_2-based ceramic fastened to the electrolyte, which serves as an anode, and NiO or another transition metal oxide that is surfactive on YSZ to the CeO_2, to prevent CeO_2 from diffusing into the YSZ. Accordingly, the anode material is not bonded to the electrolyte, whereby like materials in

the anode and electrolyte are fused together, as recited in the present claims. Rather, Mogensen teaches directly away from this aspect of the claimed invention.

> A solid state fuel cell of the above type is according to the invention characterized in that a thin layer of CeO_2-based ceramics is fastened to the electrolyte and serves as an anode, a surfactive metal oxide also being applied between the electrolyte and the ceramic layer.
>
> By adding NiO or another transition metal oxide which is surfactive on YSZ to the CeO_2, CeO_2 is prevented from diffusing into YSZ. Alternatively, a layer of such a metal oxide powder suspended in a dispersion medium can be painted on the YSZ electrolyte followed by application of the CeO_2 powder. By the expression surfactive is meant that the metal oxide, such as MnO_2 or NiO, is easy to distribute uniformly on the YSZ surface as well as that the oxide does not clot in spots on the YSZ surface during the heating process. The measure can alternatively be performed by admixing up to 30% by weight of NiO into the CeO_2-based ceramic powder. It is assumed, that a very low content of NiO suffices. Alternatively, assumed suitable auxiliary oxides are oxides of the transition metals V, Cr, Mn, Fe, Co, Cu, Zn, Nb, Ta and of Ca, Ge, In, Sn, Sb, Pb, and Bi.

Mogensen, column 2, lines 14-35 (emphasis added).

Mogensen further fails to disclose a porous anode having at least ceria, copper, or both deposited or impregnated in the pores, as recited in the present claims. The ceria is not deposited into the pores of a porous anode, but rather is formed on top of an auxiliary oxide layer that "completely covers" the YSZ surface of the electrolyte (Mogensen, at col. 2, lines 36-38. To the extent that the ceria-containing anode forms a porous structure, the anode clearly is not comprised of a porous material having at least ceria deposited or impregnated in the pores. Rather, the ceria itself is the porous material. Mogensen therefore cannot anticipate the present claims.

The Action also includes on pages 3-5 three prior art rejections under 35 U.S.C. §103 based on the following:

- Claims 2-6, 9-14, 21-27 as unpatentable over Mogensen further in view of Annumakonda, *et al.*, U.S. Patent No. 6,221,280 ("Annumakonda");
- Claims 16, 17, and 19 as unpatentable over Mogensen; and
- Claims 7, 8, 28, and 29 as unpatentable over Mogensen and Annumakonda.[1]

[1] It is not clear from the Action why this rejection was not included in the previous obviousness rejection based on the same combination of prior art.

Applicants respectfully traverse these rejections for the same reasons noted above insofar as each rejection relies on Mogensen, which as described above, fails to disclose or suggest all of the features recited in the present claims. To establish a *prima facie* case of obviousness for a claimed invention, the cited references must teach or suggest all the claim limitations. See MPEP § § 2143 and 2143.03. Here, the references, alone or in combination, fail to teach a solid oxide fuel cell comprising an anode comprising a porous material and at least ceria, copper, or both deposited or impregnated in the pores of the anode material.

As presented above in response to the anticipation rejection, the primary reference Mogensen does not teach a solid oxide fuel cell wherein the like particles of the ceramic-metal composite anode and the solid electrolyte are fused together. Mogensen fails to disclose or suggest this feature of the claimed invention, and indeed, seeks to avoid fusion by applying a surfactive metal oxide between the electrolyte and the ceramic anode material. Thus, Mogensen actually teaches away from like particles of the ceramic-metal composite anode and the solid electrolyte being fused together. A reference that teaches away from the claimed invention cannot render the claimed invention obvious (it is the antithesis of obviousness). See, *e.g.*, *Dow Chemical Co. v. American Cyanamid Co.*, 2 USPQ2d 1350 (Fed. Cir. 1897); MPEP § § 2145(X)(D)(1). Applicants also point out above the Mogensen fails to disclose a porous anode comprising a porous material with at least ceria, copper, or both deposited or impregnated into the pores, as recited in all of the independent claims. Accordingly, any obviousness rejection of the present claims based on Mogensen is improper.

Anumakonda fails to cure the deficiencies of Mogensen. Accordingly, the combination of the Mogensen and Anumakonda fails to render obvious the present claims.

The deficiencies of Anumakonda's teachings are well documented in the record. In sum, Anumakonda fails to teach a solid oxide fuel cell comprising a sulfur-containing hydrocarbon fuel. Indeed, Anumakonda teaches directly away from this aspect of the invention by requiring reformation of the fuel by use of a catalytic partial oxidation process to yield hydrogen and carbon monoxide, and then introduction of the hydrogen to the solid oxide fuel cell. Thus, Anumakonda discloses at best a solid oxide fuel cell containing hydrogen, not a sulfur-containing hydrocarbon fuel, as the fuel source. Applicants note that the claims recite a solid oxide fuel cell that contains a sulfur-containing fuel, which is directly contrary to Anumakonda's teachings. Again, a reference that teaches away from the

claimed invention cannot render the claimed invention unpatentably obvious. See, *e.g.*, *Dow Chemical Co. v. American Cyanamid Co.*, 2 USPQ2d 1350 (Fed. Cir. 1897); MPEP § § 2145(X)(D)(1).

The Action alleges that it would have been obvious to combine the references because Anumakonda teach the processing and use of a sulfur-containing hydrocarbon fuel ***to simplify the overall design of the solid oxide fuel cell system***. This appears to be the motivation relied upon by the Examiner to combine the teachings. Anumakonda does not simplify the design, but rather complicates the design of Mogensen's fuel cell system by requiring unit operations prior to the fuel cell.

The Background of the Invention section of the present application discloses various proposals to replace hydrogen with commercially available and more economical hydrocarbon fuels, but states that such raw fuels "are not currently in use as a fuel source suitable for a fuel cell because these fuel cells contain relatively high levels of sulfur" (page 2, lines 19-23). The prior art attempted to solve this problem by utilizing various methods of reforming the sulfur-containing fuels into hydrogen gas, as disclosed on pages 3 and 4 of the specification. Anumakonda, *et al.*, U.S. Patent No. 6,221,280 ("Anumakonda") describes yet another mechanism of reforming sulfur-containing fuels into hydrogen gas and carbon monoxide, ***prior to*** feeding the hydrogen gas to a solid oxide fuel cell. Anumakonda's teaching therefore results in a more complicated design, which would motivate a person skilled in the art NOT to combine it with Mogensen.

Even assuming as true the allegations in the Office Action regarding Anumakonda's reaction system providing "a simplified overall system design," the system that is simplified is a system used to reform sulfur-containing hydrocarbons. This is Anumakonda's contribution to the prior art — an alleged simplified sulfur removal process, and not a simplified fuel cell. Applicants respectfully request that the Examiner reconsider and withdraw this rejection.

Applicants respectfully submit that the Office Action fails to establish a *prima facie* case of obviousness in its rejection of claims 16, 17, and 19 as unpatentable over Mogensen. Mogensen fails to teach or suggest all of the elements of the present claims, and actually teaches away from the present invention. Accordingly, any obviousness rejection of the

present claims based on Mogensen would be misplaced. Applicants respectfully request that the Examiner reconsider and withdraw this rejection.

Applicants respectfully submit that the Office Action fails to establish a *prima facie* case of obviousness in its rejection of claims 7, 8, 28, and 29 as unpatentable over Mogensen and Annumakonda. The Action merely alleges, without any supporting evidence, that it is well known in the art that methane and alcohols are functionally equivalent hydrocarbon fuels. This is improper. Even if the unsupported technical allegations of functional equivalents were true, however, the combined teachings of the prior art still fails to render obvious the present claims. Applicants provide sufficient detailed argument above regarding the reasons why the combined teachings of Mogensen and Anumakonda fail to teach or suggest all of the elements of the present claims, and actually teach away from the presently claimed invention. Accordingly, any obviousness rejection of the present claims based on Mogensen or Anumakonda would be misplaced.

In view of the foregoing, applicants respectfully submit that the present claims are in condition for allowance. An early notice to this effect is earnestly solicited. Should there be any questions concerning this response, Examiner Yuan is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

July 26, 2006
Date

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